GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
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Project Director: Phillip W. Potts

US

Sponsor: Agency for International Development/Ecuador; Quito, Ecuador

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SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 10/12/84

Project No. A-2766 ~~School~~/Lab TAL

Includes Subproject No.(s)

Project Director(s) Phillip W. Potts GTRI / ~~GIT~~

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Title Local Manufacture of AID Pumps and Robo Devices in Ecuador

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Grant/Contract Closeout Actions Remaining:

- [ ] None
- [x] Final Invoice or Final Fiscal Report
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GIT Project A-2766

LOCAL MANUFACTURE OF AID HAND PUMPS AND ROBO DEVICES IN ECUADOR

Prepared for
The U.S. Agency for International Development Mission to Ecuador
under Contract No. AID 518-451

by
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Technology Applications Laboratory
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GEORGIA INSTITUTE OF TECHNOLOGY
September 1984

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Georgia Tech was assigned responsibility in mid-1980 for determining the feasibility of locally manufacturing the AID hand-operated water pump, the Roboscreen (a plastic well screen/filter), the Robovalve (a plastic water faucet) and the Robometer (a user-activated water meter) in Ecuador. As a result of this feasibility study, a cost reimbursement contract between Georgia Tech and the USAID Mission was signed in September 1980 whereby Georgia Tech was to provide technical assistance to the Government of Ecuador and the U.S. Agency for International Development Mission to Ecuador in locally manufacturing AID hand pumps, Roboscreen, and Robovalves and assuring their appropriateness for introduction into bilateral health projects which include water supply components.

Forty-seven AID hand pumps were manufactured by the National Polytechnic School in Quito, Ecuador. The first five hand pumps were delivered to Georgia Tech field engineers in December 1981 with very good casting quality, but the machining was far from desirable, especially in conforming to dimensional tolerances. The remaining 42 hand pumps were delivered to Georgia Tech personnel in March 1982 with very good casting quality and considerably improved machining, but still less than desirable. The hand pumps were then installed and maintained by the Voz Andes Hospital's Community Development Department with a cylinder of ABS (acrylonitrile-buatadiene-styrene) produced by Industrias Ecuatoriana de Productos Electronicos, S.A. (IEPESA), a local plastics manufacturer. Nineteen of the Voz Andes sites were visited and inspected for the last time by Georgia Tech personnel in March of 1984, approximately two years after most of the pumps had been installed. Seventeen of the 19 pumps were working well except one at Chacahuaico where the water flow was poor, possibly from worn leather cups. The two pumps not working, Santo Tomas and Pulacate #1, had been reported and were scheduled to be repaired in

the next several days. Lubrication of the 19 pumps ranged from very good to poor.

Two thousand Robovalves were manufactured by IEPESA. Manufacture presented three problems. The first one concerned the somewhat dispersed discharge of water at pressures greater than 10 p.s.i (pounds per square inch), which was solved with a minor modification to the spout mold. The second problem involved separation of Robovalve components at high pressures, and was solved by using a better cement and a longer curing time. The third problem involved poor machining practices, which were eventually corrected through technical assistance. Prior to accepting the Robovalves from IEPESA, each valve was tested by Georgia Tech or IEPESA personnel at varying pressures (5-60 p.s.i.).

It was intended that the Robovalves be installed in the adjoining communities of San Juan and Sarapamba of the Province of Cotopaxi as a component of a gravity-fed water system. Approximately 25 of the Robovalves were actually installed. However, the villagers felt that the plastic Robovalves were inferior to traditional metal faucets which did not require constantly holding a button down to get water as with the Robovalve. As a result, the villagers removed the Robovalves and replaced them with metal faucets or broke the Robovalves so that they had to be replaced. In short, the Robovalves were found to be culturally unacceptable, and their installation was suspended.

Roboscreen manufacture also required technical assistance and monitoring. After receiving a formal quote from IEPESA, an order was placed with IEPESA for the production of 500 pieces of two-inch Roboscreen and 500 pieces of four-inch Roboscreen. Various problems in manufacturing the Roboscreen were encountered; for examples, determining the proper ratio of acrylonitrile, butadiene and styrene for an ABS mixture and machining helical slots in the screen were both difficult. However, such problems were resolved through technical assistance.

The two-inch Roboscreen pieces were installed as filters in spring boxes by the Ecuadorian Institute of Sanitary Works (IEOS) in the provinces of Cotopaxi, Tungurahua and Chimborazo. They have worked extremely well in each of these three areas of Ecuador, with IEOS reporting no problems in installation or operation.

The four-inch Roboscreen was turned over to IEOS' Groundwater Division for installation as well screen. However, IEOS has not installed any of it because of a feeling that the short sections (12 inches in length) are inappropriate, when compared to longer conventional sections (for instance, four to six feet) of well screen, since the shorter sections require much more work during installation. Due to the success of the two-inch Roboscreen in spring boxes, it is recommended that the four-inch Roboscreen also be used in the construction of spring boxes.

Epilogue

As a result of the AID hand pump pilot manufacturing program described in this report, IEOS requested bids for 1,000 AID pumps in April 1982. IEOS subsequently placed an order for 1,000 AID hand pumps with Tirado Hermanos, located in Ambato, and a second order for 50 AID hand pumps with Metalurgica Ecuatoriana, located in Quito, as an alternate supplier. Technical assistance was given to both manufacturers by Georgia Tech through AID/Washington's centrally-funded Water and Sanitation for Health (WASH) Project.

Approximately 400 of the 1,000 Tirado Hermanos hand pumps have been manufactured and accepted by IEOS and are now being installed by IEOS with no reported problems. The remaining pumps have been cast, but not machined and assembled.

The 50 Metalurgica Ecuatoriana hand pumps, purchased and paid for by Voz Andes Hospital, have been manufactured and installed in Chimborazo Province. Voz Andes Hospital also is maintaining these hand pumps, and no problems have been reported with the pump's performance.

ACKNOWLEDGEMENTS

This program of establishing manufacturing capabilities for AID hand-operated water pumps, Roboscreen (a plastic well screen/filter) and Robovalves (a plastic water faucet) would never have succeeded without the help of many individuals who have supplied large quantities of information and have given freely of their time, permitting project personnel to profit from their seasoned judgment. This program did not contractually require active participation by the USAID Mission or the U.S. Peace Corps in Ecuador, but assistance was given abundantly in the form of personnel, coordination of program activities, and interest and insight into local conditions within Ecuador. Personnel of Voz Andes Hospital's Community Development Program in Ecuador contributed significantly with their own resources of vehicles, tools, and employees possessing noteworthy technical skills, dedication, and professionalism.

While it is impossible to list all individuals who have rendered assistance to the program, the author of this report would like to acknowledge with a note of appreciation Dr. Kenneth Farr and Mr. Herbert Caudill of the USAID Mission, Mr. Jon Seval of Voz Andes Hospital, Mr. John Kenyon of the Peace Corps, Mr. Justin Whipple of the Central American Research Institute for Industry (ICAITI), and Mr. Robert Knight of the University of Maryland.

1. BACKGROUND

Georgia Tech was assigned responsibility in mid-1980 for determining the feasibility of locally manufacturing the AID hand-operated water pump, the Roboscreen (a plastic well screen/filter), the Robovalve (a plastic water faucet) and the Robometer (a user-activated water meter) in Ecuador.

While available data varied on the need for water supply programs in Ecuador, it was quickly recognized that much could be done to improve conditions for Ecuadorian citizens, especially those in the rural areas, in providing safer, more convenient water. The leading causes of death (though only 1/2 of all deaths were medically certified) were related to underdevelopment and poor environmental conditions, and often preventable: diarrheal diseases, respiratory illnesses, measles, nutritional deficiencies and pneumonia. Health status, of course, is conditioned by a large number of variables such as rural versus urban setting, educational levels, income and numerous other socio-economic factors, in addition to the availability of health services. But the factors of most widespread impact on the disease problems and which were largely within the health sector's responsibility bureaucratically, were environmental sanitation and water supply. Household connections to public water supplies in 1978 covered 85% of the urban population, but for the 56% of the national population living in rural areas, coverage was only 16%. The effects of lack of access to water on not only health but overall economic development could hardly be overestimated.

Fortunately, considerable activity was underway or being planned for improving the above situation by the Government of Ecuador as well as development agencies (USAID/Ecuador, CARE and the Community Development Department of Voz Andes Hospital, for example). Because there was a great need for improved water supply in Ecuador and because there was activity underway or being planned by the Government of

Ecuador and development agencies, it seemed natural that local manufacture of as much as possible of the needed hardware should be stressed.

The manufacturing capabilities of foundries, machine shops and plastics manufacturers were more than sufficient for local manufacture of the AID hand pump, the Robovalve, the Roboscreen and the Robometer. The lowest estimate during this study for manufacturing the AID hand pump by an Ecuadorian foundry and machine shop was $150 (U.S.). This cost estimate was particularly attractive to USAID/Ecuador when considering the cost of importing a comparable hand pump from the United States at $250-300, creating in-country employment through local manufacture, and having a readily available source for spare parts. The cost of manufacturing the Robovalve was estimated at $.84 (U.S.) for a household model and $1.32 (U.S.) for a public standpost model; and, when considering their possibilities for years of maintenance-free operation, they could be very cost effective (locally available metal faucets in Ecuador cost between four and five U.S. dollars in the retail market at that time).

Cost estimates showed that the cost for manufacturing the Roboscreen, when used either as a well screen or as a filter for hand pumps, would have been less than $2 (U.S.) per linear foot (as compared to $40-$50 U.S. per linear foot for some commercially-available well screen) and the Roboscreen would not corrode since it is produced from plastic.

Cost estimates were not obtained for the Robometer because of the lack of a proper prototype or design drawings. However, it was felt that this device could be manufactured in Ecuador for less than $50 (U.S.).

Based on the above, it appeared that a pilot program involving the local manufacture of AID hand pumps, Robovalves and Roboscreen in Ecuador would be feasible. Because of a lack of a fully developed prototype of the Robometer, it was recommended that four or five be made in the United States and field tested in Ecuador for social acceptability as well as technical feasibility. As the manufacturing process was carried out, the finished products would then be incorporated into water supply programs either currently underway or planned for the future. With regard to these devices there were several programs that would be particularly appropriate for their use:

1. Center for Rehabilitation of Manabi hand pump program

2. Salcedo Integrated Rural Development Project

3. Quimiag-Penipe Integrated Rural Development Project

4. USAID/Ecuador and Ecuadorian Institute of Sanitary Works (IEOS) capability development program which included design testing and evaluation of potable water and excreta disposal systems

5. Voz Andes Hospital Community Development Program

6. CARE in Chimborazo Province.

In addition to the above, an attractive and promising alternative was to get the Peace Corps in Ecuador involved in rural water supply programs through the use of the AID hand pump and Robo devices. While the Peace Corps in Ecuador was not at that time involved in water supply programs, there was at least one in-country volunteer with a bachelor's degree in civil engineering and a master's degree in sanitary engineering who could plan and implement programs involving the AID hand pump and Robo devices.

2. ESTABLISHMENT OF LOCAL MANUFACTURING CAPABILITY

As a result of the feasibility study described in the previous section of this report, a cost reimbursement contract between Georgia Tech and the USAID Mission was signed in September 1980 whereby Georgia Tech was to provide technical assistance to the Government of Ecuador and the U.S. Agency for International Development Mission to Ecuador in locally manufacturing AID hand pumps, Roboscreen, and Robovalves and assuring their appropriateness for introduction into bilateral health projects which include water supply components. The Central America Research Institute for Industry (ICAITI) was then subcontracted by Georgia Tech to assist in carrying out the technical assistance activities because of its previous involvement with Georgia Tech in AID hand pump programs in Nicaragua and Costa Rica. Mr. Robert Knight, a member of the University of Maryland staff, was contracted by Georgia Tech as a consultant because of his involvement in the development of the Robo devices.

AID Hand Pumps

AID Hand Pump Manufacture. A sizeable number of foundry/machine shop complexes exist in Ecuador, especially in or near the principal cities of Quito and Guayaquil. Three of these complexes, plus the National Polytechnic School in Quito, were visited when determining the feasibility of manufacturing the AID hand pump in Ecuador (see Figures 1 and 2). Each of these four organizations expressed a strong interest in producing the hand pump, and all appeared to have technical capability to do so.

In early November 1980, after in-depth discussions between Georgia Tech, ICAITI, USAID Mission and IEOS representatives, the decision was made to purchase 110 AID deep-well hand pumps from the National Polytechnic School (Escuela Politecnica Nacional). The National Poly-

AID HAND–OPERATED WATER PUMP
SHALLOW WELL

(For Wells less than 7-8 meters in depth)

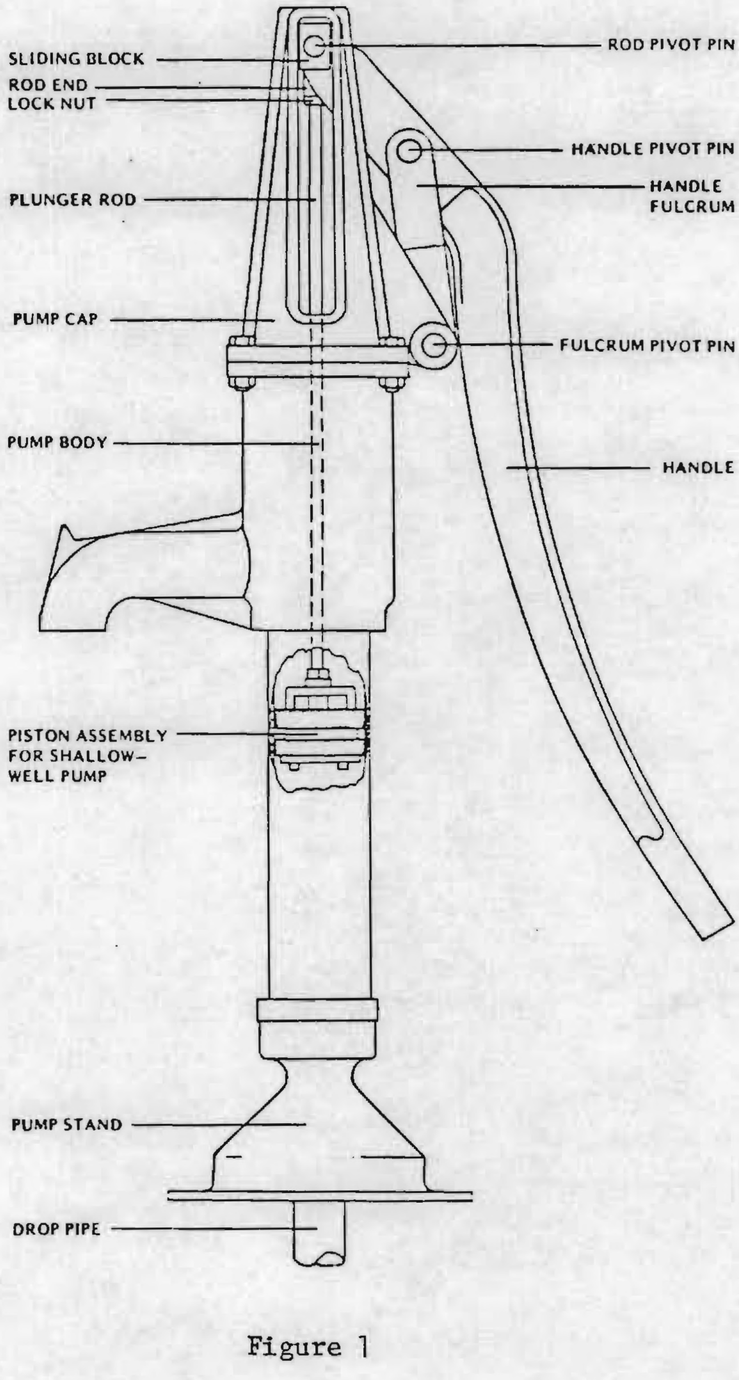


Figure 1

AID HAND–OPERATED WATER PUMP
DEEP WELL

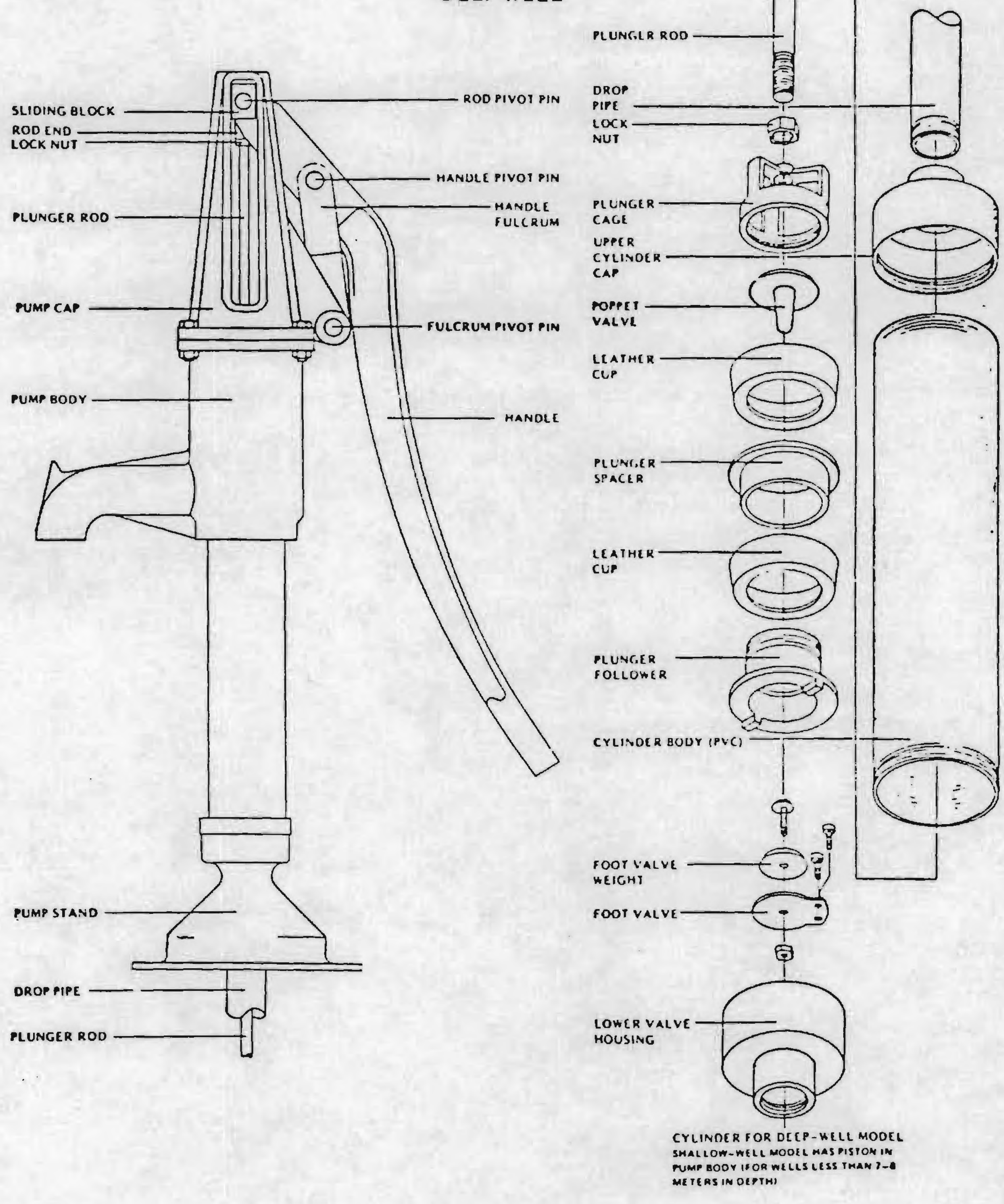


Figure 2

technic School, a technical/vocational school, had more than adequate foundry and machine shop facilities used for the manufacture of various metallic products which were sold at cost. In addition, the USAID Mission, IEOS and the National Polytechnic School felt that there were two important benefits to be derived from producing the AID hand pump at the National Polytechnic School: (1) the students would get practical training while participating in the manufacturing process and (2) the school's faculty would get exposure to extension activities by assisting Georgia Tech and ICAITI in training for well development, water quality analysis, water disinfection, and hand pump installation, maintenance and repair. The unit cost of the 110 hand pumps was to be 4,000 sucres ($160 U.S. with a currency exchange rate of 25 sucres per $1.00 U.S.). Estimated delivery of the finished hand pumps was to be May of 1981.

During the next 13 months (December 1980-December 1981) the National Polytechnic School experienced numerous unusual and unexpected problems before the first five hand pumps were inspected and received by Georgia Tech/ICAITI project personnel in December 1981. Pig iron in the local market was scarce. Molding sand could not be found in the Quito area and was eventually brought in by truck from Guayaquil. The machine shop was closed for several months for building repairs after heavy rains damaged its roof. National labor strikes which affected the entire country were frequent. Most of all, the National Polytechnic School had frequent problems in scheduling production of the hand pumps and then adhering to the schedule.

Because of the many delays in the National Polytechnic School's producing the hand pumps in a timely manner, a meeting, attended by representatives from Georgia Tech, ICAITI, the USAID Mission and the National Polytechnic School, was held in January 1982 to discuss delivery of the 105 hand pumps yet to be finished. During this meeting, the project history was reviewed in detail. National Polytechnic School representatives agreed that project goals were not being met and explained that factors beyond their control (strikes, a war with Peru, etc.) were the primary causes of their production delays. The

National Polytechnic School also presented a large amount of cost information which showed cost of production for the hand pumps approximately 1.6 times higher than originally estimated, that is, 6,400 sucres ($256 U.S.) rather than 4,000 sucres ($160 U.S.) per pump, due to inflation.

The net result of the meeting was that all parties (Georgia Tech, ICAITI, the USAID Mission and the National Polytechnic School) agreed to a revised schedule whereby the National Polytechnic School would provide a total of 47 hand pumps, rather than 110, at a unit cost of 6,400 sucres ($256 U.S.), rather than 4,000 sucres ($160 U.S.), no later than March 31, 1982. The revised number of hand pumps, 47, was agreed to because Georgia Tech had already advanced the National Polytechnic School $12,000 (U.S.), the equivalent of 47 hand pumps at a unit price of $256, and budgetary constraints prevented putting more funds into a larger number of pumps.

A total of 47 AID hand pumps were produced at the National Polytechnic School by March 1982. The five pumps delivered in December 1981 were of very good casting quality, but the machining was far from desirable, especially in conforming to dimensional tolerances. The remaining 42 pumps also were of very good casting quality and their machining a considerable improvement, but still less than desirable.

<u>AID Hand Pump Cylinder Manufacture</u>. Two PVC (polyvinyl chloride) pipe manufacturers were identified in mid-1980 while determining the feasibility of locally manufacturing the AID hand pump and the Robo devices as potential suppliers of pipe for hand pump cylinders. One, Conductores Electricos, S.A., located near Quito, produced two-inch, three-inch, and four-inch pipe in various weights, all of which had wall thicknesses too thin for threading.

Information obtained by telephone from the other plastics manufacturer, Plastigama, located in Guayaquil, revealed that it did make heavy guage pipe adequate for threading which was sold wholesale and retail throughout Ecuador. Visits to retail hardware stores in Quito provided brochures which showed Plastigama's products, including three-inch PVC pipe close to Schedule 40 specifications. However, none of these hardware stores had the three-inch pipe in inventory.

Shortly after the AID hand pumps were ordered from the National Polytechnic School, the National Polytechnic School advised Georgia Tech project personnel that Schedule 40 PVC in three-inch diameters was not available in small quantities (approximately 2,000 linear feet). This was confirmed by Plastigama. Searches of local hardware stores again failed to show any three-inch pipe in inventory, and it appeared that the material would have to be imported from a neighboring country or from the United States.

The problem of finding a supplier of the three-inch PVC pipe for hand pump cylinders was then discussed with a local plastics manufacturer, Industrias Ecuatoriana de Productos Electronicos, S.A. (IEPESA), while soliciting a cost estimate for the manufacture of Robovalves. IEPESA's recommendation, which proved to be very worthwhile, was to have IEPESA injection-mold the cylinders from the same polymer as the Robovalves, ABS (acrylonitrile - butadiene - styrene). Following a formal cost estimate by IEPESA, 150 cylinders were ordered at a unit price of 80 sucres ($2.67 U.S. with a currency exchange rate of 30 sucres per $1.00 U.S.), plus a mold charge of 32,000 sucres ($1,067 U.S.). The cylinders were molded, as shown in Figure 3, with the addition of threading at both ends. After some experimentation with various resins of different ratios in which the three monomers, acrylonitrile, butadiene and styrene, were to be combined, a 70 percent Borg Warner CYCOLAC DFA-R and 30 percent Dow Chemical SAN combination was used. The most outstanding feature of the finished cylinders, when compared to PVC-extruded cylinders, was the extremely smooth internal surface finish.

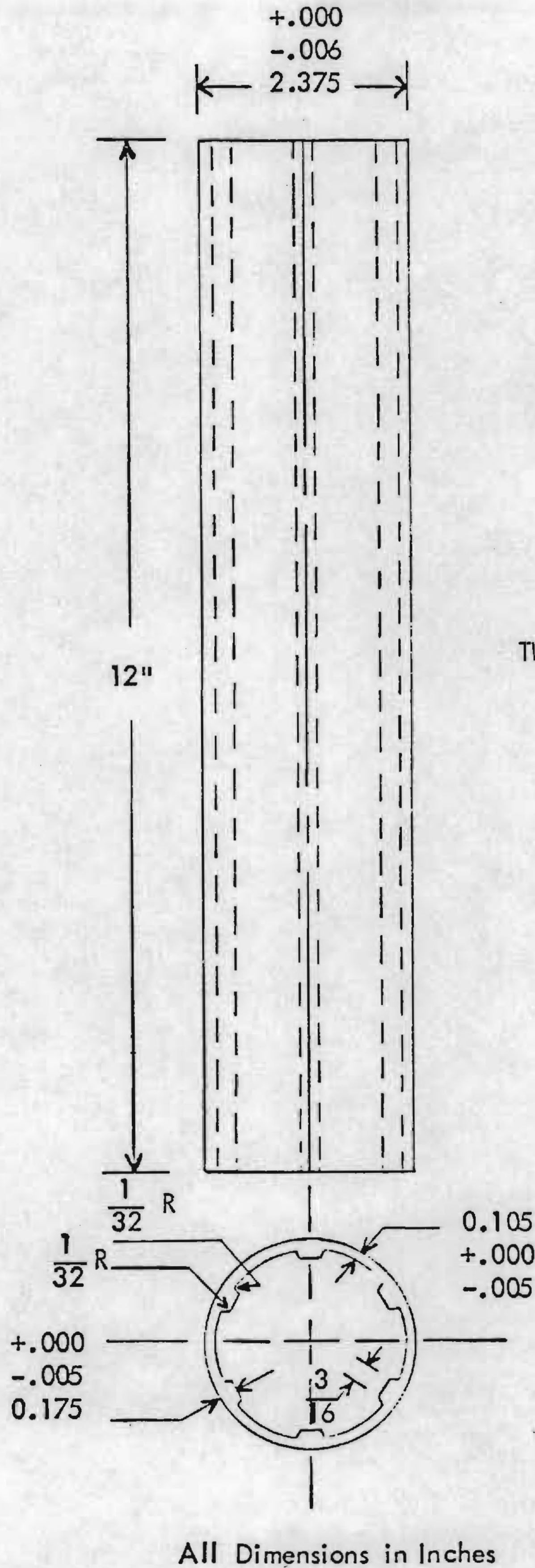
Roboscreen Manufacture

In manufacturing Roboscreen, project personnel originally planned to purchase stock Schedule 40 PVC pipe in two-inch and four-inch sizes, shave portions of the inside of the pipe with a broaching tool developed at the University of Maryland to form internal strengthening ribs, then slot the screen with a helical cut on a lathe equipped with a grinding head where a small (2 3/4 inch diameter) circular saw is substituted for the grinding wheel. Using this approach, it would be possible to slot the screen satisfactorily with slots as fine as 0.018 inches.

As with the PVC for the AID hand pump cylinder, Schedule 40 PVC pipe in two-inch and four-inch sizes for the Roboscreen was found to be unavailable. IEPESA again offered a very worthwhile recommendation, that is, injection-molding the pipe sections with ABS, including the ribs, then slotting the pipe segments into well screen. This would also eliminate the machining processes of cutting 20-foot pipe into 12-inch segments and the broaching.

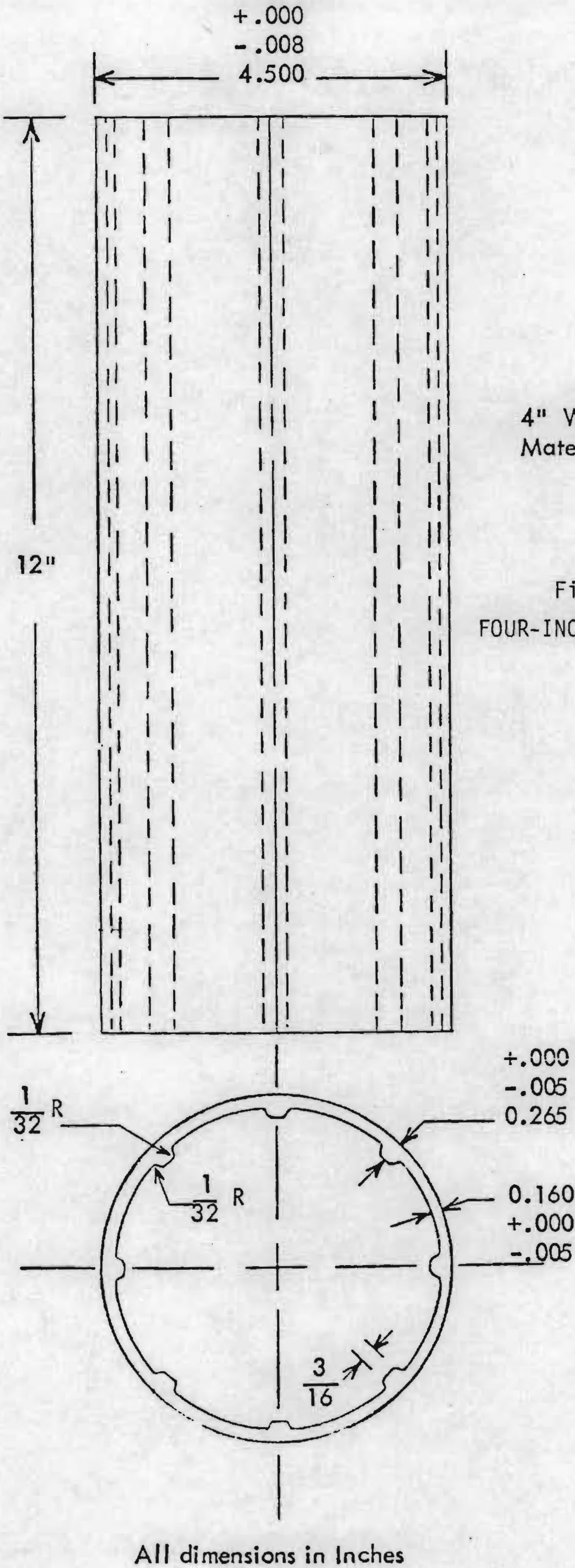
After receiving a formal quote from IEPESA, an order was placed with IEPESA for 500 pieces of two-inch Roboscreen (see Figure 4) at a unit price of 39 sucres ($1.30 U.S. with a currency exchange rate of 30 sucres per $1.00 U.S.) and 500 pieces of four-inch Roboscreen (see Figure 5) at a unit price of 79 sucres ($2.63 U.S.). The cost of the two-inch mold was 32,000 sucres ($1,067 U.S.) and the four-inch mold 40,000 sucres ($1,333 U.S.).

Initial experimentation with the ABS monomers provided samples that appeared to be too tacky or too brittle for slotting. However, the same combination used for the AID hand pump cylinder was eventually selected, and the screen was molded. Machining of the helical slots presented problems in that the tackiness of the ABS mixture required slotting with the circular saw to be done at a very slow speed and with two passes, or cuts, which was time-consuming and left a rough



2" Well Screen
Material: ABS

Figure 4
TWO-INCH ROBOSCREEN



4" Well Screen
Material: ABS

Figure 5
FOUR-INCH ROBOSCREEN

All dimensions in Inches

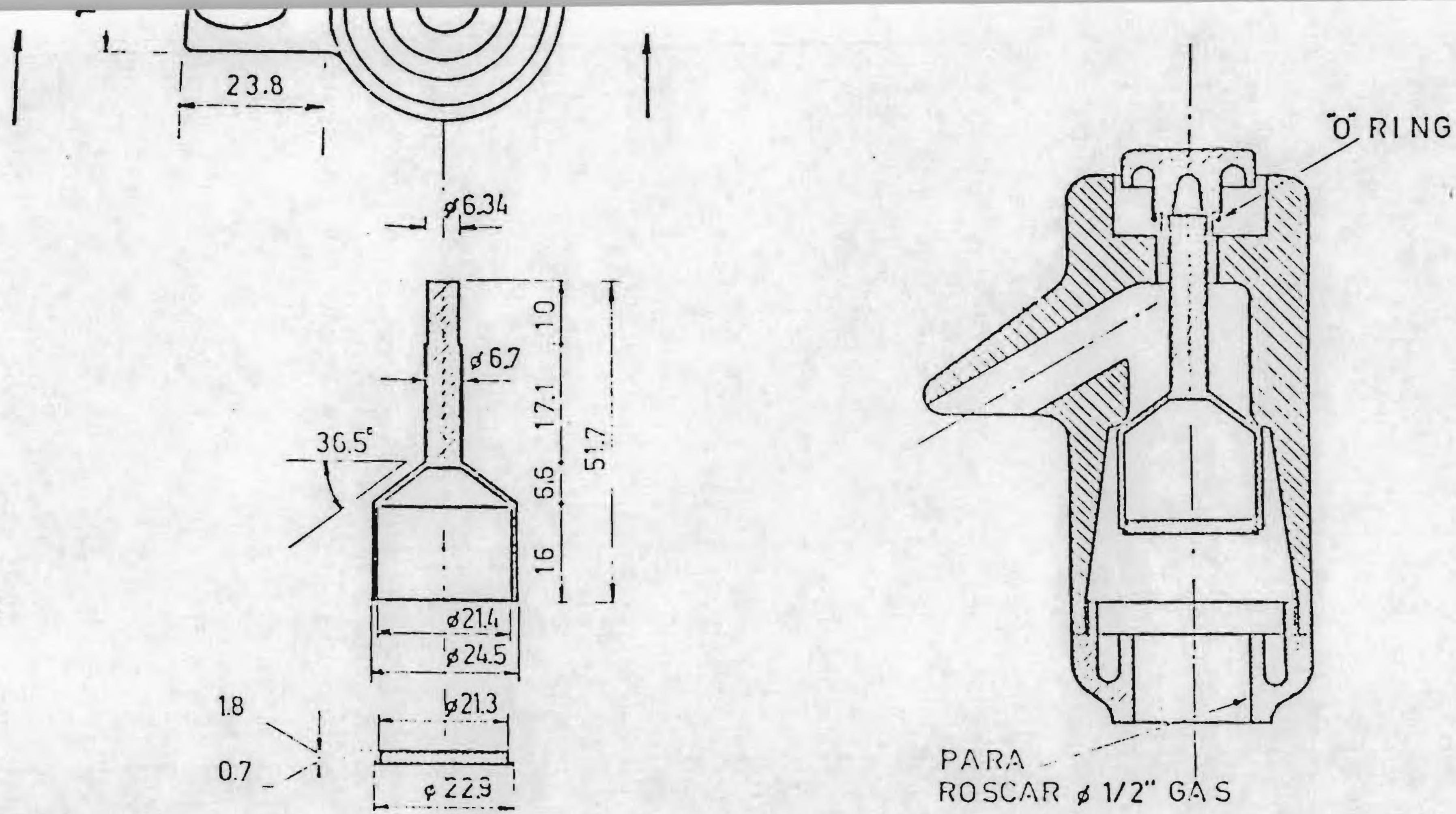
finish which necessitated cleaning afterwards. These machining problems were resolved by switching from the circular cutting saw to a single point cutting tool with a .015 inch tip.

Robovalve Manufacture

It was found during the feasibility study for local manufacture of AID hand pumps and Robo devices that Ecuador had a number of industrial firms active in the plastic injection-molding field, two of which were located just outside of Quito: Rhenania, S.A. and IEPESA. Both companies appeared capable of satisfactorily molding components for the Robovalve, but Rhenania would have to import molds from the United States, while IEPESA had an excellent tool and die shop for making its own multi-cavity production molds. Both would have to use ABS since neither had the equipment for molding rigid PVC.

Because of IEPESA having a tool and die shop and having assisted so much in solving the problems associated with producing the AID hand pump cylinder and the Roboscreen, a formal quote for manufacturing the Robovalve was requested from IEPESA management. The resulting quote listed a unit price of 43.8 sucres ($1.62 U.S. with a currency exchange rate of 27 sucres per $1.00 U.S.) with a mold charge of 133,000 sucres ($4,926 U.S.). An order was then placed with IEPESA for the manufacture of 2,000 Robovalves (see Figure 6).

Borg Warner CYCOLAC DFA-R was used exclusively in molding the Robovalves. Manufacture presented three problems. The first one concerned the somewhat dispersed discharge of water at pressures greater than 10 p.s.i. (pounds per square inch) which was solved with a minor modification to the spout mold. The second problem involved separation of Robovalve components at high pressures, and was solved by using a better cement and a longer curing time. The third problem involved poor machining practices which were eventually corrected through technical assistance. Prior to accepting the Robovalves from IEPESA, each valve was tested by Georgia Tech or IEPESA personnel at varying pressures (5-60 p.s.i.).



Material

ABS Cycolac

Figure 6
ROBOVALVE

	Fecha	Nombre	Firma	INDUSTRIAS IEPESA QUITO - ECUADOR DEPARTAMENTO DE INGENIERIA	
Proyecto					
Esquem					
Dibujó	80 12 18	Washington Egas P.			
Controlo	80 12 18	Ing Pietro Cozzaglio			
Aprobo		Ing Robert Knight			
Escala 1:1 medidas en mm.	VALVULA			Nº Archivo	E115
				Cambia de	
				Cambia a	

3. INSTALLATION, MAINTENANCE AND REPAIR OF AID HAND PUMPS AND ROBO DEVICES

AID Hand Pumps

Two AID deep-well hand pumps were shipped from Indonesia to Ecuador during the early stages of this project to establish local capabilities for manufacture of the AID hand pump. One of these pumps was used as a model in manufacturing pumps in Ecuador. The other pump was used in training Voz Andes personnel to develop wells and to install, maintain and repair AID hand pumps at a rural community near Riobamba in the Province of Chimborazo. The five pumps manufactured in December 1981 by the National Polytechnic School also were used for training Voz Andes personnel while being installed in Chimborazo. Voz Andes then installed the remaining National Polytechnic School pumps, and has ably maintained and repaired them with the assistance of a Peace Corps Volunteer, Mr. John Kenyon. All hand pumps, it should be noted, were installed with a metal foot valve brought into Ecuador by Georgia Tech project personnel to replace the AID hand pump's traditional leather foot valve which has not been reliable in other countries.

Nineteen of the Voz Andes sites were visited and inspected for the last time under this project by Georgia Tech in March of 1984 (see Table 1), approximately two years after most of the pumps had been installed. Seventeen of the 19 pumps were working well except one at Chacahuaico where the water flow was poor, possibly from worn leather cups. The two pumps not working, Santo Tomas and Pulacate #1, had been reported and were scheduled to be repaired in the next several days. Lubrication of the 19 pumps ranged from very good to poor.

TABLE I

MARCH 1984 INSPECTION OF VOZ ANDES AID HAND PUMP SITES

	COMMUNITY	DATE PUMP INSTALLED	WELL DEPTH (METERS)	# OF USERS (FAMILIES)	COMMENTS
1.	Troje	12-4-81	6.2	10	Good flow, easy movement, no noticeable wear. Local villagers report that the pump is lubricated weekly.
2.	Meraflores	12-5-81	7.0	40	Good flow, hard movement, no lubrication, no noticeable wear.
3.	Lupaxi	9-5-83	5.5	20	Good flow, well lubricated, easy movement.
4.	Santo Tomas	6-8-82	12.6	45	Pump not working (plunger rod separation) for past five days. Sliding blocks and guides well lubricated. Handle fulcrum not lubricated. No noticeable wear.
5.	Pulucate #1	Jan. '83	4.0	100	Pump not working (missing handle fulcrum pin and broken base threads). Poorly lubricated.
6.	Pulucate #2	6-7-82	29.3	31	Not well lubricated, easy motion, good flow.
7.	San Jose	12-5-81	7.0	20	Pump in excellent condition, good flow, easy motion, well lubricated.
8.	Calancha #1	3-15-82	8.0	30	Pump in excellent condition, good flow, easy motion, well lubricated except for handle fulcrum.

TABLE 1 (Continued)

MARCH 1984 INSPECTION OF VOZ ANDES AID HAND PUMP SITES

	COMMUNITY	DATE PUMP INSTALLED	WELL DEPTH (METERS)	# OF USERS (FAMILIES)	COMMENTS
9.	Calancha #2	12-15-81	4.4	35	Good flow, easy motion, no lubrication on handle fulcrum, poor drainage. Pump has PVC pipe hooked up to pump water to storage tank used for washing clothes.
10.	Lupaxi #1	2-16-81	4.4	50	Pump lubricated except for handle fulcrum, good flow, easy motion.
11.	Lupaxi #2	12-4-81	5.7	30	Pump well lubricated, good flow, easy motion.
12.	Lupaxi #3	4-1-82	5.0	40	Pump leaking at body-base threads, not well lubricated, stiff motion, good flow.
13.	Lupaxi #4	4-10-82	7.0	30	Pump in excellent condition, good flow, easy motion.
14.	S.A. Chaupi	7-21-82	6.0	14	Bushings in handle fulcrum loose, no lubrication on handle fulcrum and very little lubrication on rest of pump. Good flow.
15.	Chacahuaico	7-14-82	4.2	30	Loose anchor bolts, good flow, easy motion. Some lubrication.
16.	S.A. Chaupi	5-12-82	6.0	35	Pump in excellent condition, easy motion, good flow.

TABLE 1 (Continued)

MARCH 1984 INSPECTION OF VOZ ANDES AID HAND PUMP SITES

COMMUNITY	DATE PUMP INSTALLED	WELL DEPTH (METERS)	# OF USERS (FAMILIES)	COMMENTS
17. Chacahuaico (school)	3-26-82	6.0	N.A. (school)	Pump in excellent condition, easy motion, good flow.
18. Chacahuaico	7-14-82	4.5	22	Stiff motion, not well lubricated, poor flow, leakage under the base.
19. Castuj, T.	7-27-82	4.5	20	Pump lubricated well except for handle fulcrum, easy motion, good flow.

Roboscreen

The two-inch Roboscreen pieces were installed as filters in spring boxes by IEOS in the provinces of Cotopaxi, Tungurahua and Chimborazo. They have worked extremely well in each of these three areas of Ecuador, with IEOS reporting no problems in installation or operation.

The four-inch Roboscreen was turned over to IEOS' Groundwater Division for installation as well screen. However, IEOS has not installed any of it because of a feeling that the short sections (12 inches in length) are inappropriate, when compared to longer conventional sections (for instance, four to six feet) of well screen, since the shorter sections require much more work during installation. Due to the success of the two-inch Roboscreen in spring boxes, it is recommended that the four-inch Roboscreen also be used with the construction of spring boxes.

Robovalves

It was intended that the Robovalves be installed in the adjoining communities of San Juan and Sarapamba of the Province of Cotopaxi as a component of a gravity-fed water system. Approximately 25 of the Robovalves were actually installed. However, the villagers felt that the plastic Robovalves were inferior to traditional metal faucets which did not require constantly holding a button down to get water as with the Robovalve. As a result, the villagers removed the Robovalves and replaced them with metal faucets or broke the Robovalves, so that they had to be replaced. In short, the Robovalves were found to be culturally unacceptable, and installation was suspended.

4. EPILOGUE

Following the AID hand pump pilot manufacturing program previously described in this report, IEOS requested bids for 1,000 AID pumps in April 1982. As described in AID/Washington's centrally-funded Water and Sanitation for Health (WASH) Project Field Report No. 123 of May 1984, after bids were submitted, Georgia Tech was asked by the WASH Project contractor, Camp Dresser and McKee, to evaluate the capabilities of four manufacturers who responded (Metalurgica Ecuatoriana, Siderurgica Guayaquil, Ferroaleacion, and Ing. Nelson Ioaza). This evaluation was conducted in May 1982 by the author of this report and Mr. Justin Whipple of ICAITI, a consultant to Georgia Tech. In the resulting report to Dr. Kenneth Farr, Chief Health Officer of the USAID/Ecuador Mission, it was concluded that Metalurgica Ecuatoriana, a foundry/machine shop located in Quito, was superior to the other three manufacturers with respect to the ability to produce 1,000 AID design hand pumps to specifications and in a timely manner. However, IEOS decided that all of the bids were too high and declared the bidding process void. Under Ecuadorian law and practice, this declaration then enabled IEOS to purchase the 1,000 hand pumps with a "sole source" contract. Georgia Tech was then asked to evaluate two manufacturers who had not previously submitted bids and to re-evaluate one manufacturer from the previous solicitation. In June 1982, this evaluation of Tirado Hermanos, Hansa and Metalurgica Ecuatoriana was conducted by Georgia Tech. The conclusions reached from this evaluation were:

- Tirado Hermanos had the potential capability to manufacture AID hand pumps providing they were given adequate technical assistance.

- Hansa should be eliminated from further consideration.

- Metalurgica Ecuatoriana had existing capability to manufacture AID hand pumps.

Due to a large difference in the quoted prices of the two qualified manufacturers, Georgia Tech recommended that a major portion of the pump order be placed with Tirado Hermanos and that they be provided with extensive technical assistance. In order to assure a second source of hand pumps, it was further recommended that a minor portion of the pump order be placed with Metalurgica Ecuatoriana and that they be provided with the technical assistance as required.

Based on the findings of this second evaluation and on resubmitted bids, USAID/Ecuador and IEOS decided to place an order for 1,000 hand pumps with Tirado Hermanos, located in Ambato, and an order for 50 hand pumps with Metalurgica Ecuatoriana, located in Quito.

Metalurgica Ecuatoriana was a relatively large foundry/machine shop complex that not only did special order ferrous and non-ferrous casting and machining but produced an extensive line of heavy woodworking machinery. The owner and his son, both engineers, managed the company. Their foundry and machine shop were well-equipped and managed. The major technical assistance given this company was the provision of a set of jigs and fixtures which had been fabricated in Honduras during a similar hand pump project. These jigs and fixtures insured that the drilled bolt holes in the pump body, cap, and base were uniform and dimensionally correct. This tooling also assured dimensionally correct bushing holes in the fulcrum, handle and pump cap. Very little technical assistance was required for this company to produce an acceptable AID design hand pump. The 50 pumps, purchased and paid for by Voz Andes Hospital, have been installed in Chimborazo Province and are being maintained by Voz Andes. No problems have been reported with the pump's performance.

Tirado Hermanos was a relatively small foundry/machine shop that specialized in casting and machining replacement parts such as large gears, truck brake drums, and various machine parts. The company was managed by three brothers who also worked in the foundry and machine shop. Extensive technical assistance was provided this company in areas of foundry processes, heat treating, jigs and fixtures, quality control, cost control and production control. Approximately 400 of the 1,000 pumps have been completed and accepted by IEOS. The remaining pumps have been cast, but not machined and assembled.